



## Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at <http://about.jstor.org/participate-jstor/individuals/early-journal-content>.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact [support@jstor.org](mailto:support@jstor.org).

## BOOK REVIEWS

*Der Geruch.* By HANS HENNING. Leipzig, Barth, 1916, viii, 533 pp.

Henning's notable contribution to the psychology of smell first appeared in the *Zeitschrift für Psychologie*. Its parts are scattered through various numbers, beginning with the one dated October, 1915 and ending with that dated September, 1916. The appendix of the book contains not only a special study of the sense of smell in ants but also a very important discussion of taste-qualities. Both these papers appeared in the number of the *Zeitschrift* dated February, 1916. The bound volume contains a few additional notes, a name-index and an index to the scents discussed.

In the opinion of the reviewer, Henning's work marks the beginning of a new era in the study of smell and probably also in that of taste. In his treatment of his predecessors, Henning is a ruthless—in fact, a very uncivil—iconoclast. To change the figure, he forgets that if the work of Zwaardemaker, Nagel and Aronsohn had not been done, he would have had to break some quite rocky ground which, as a matter of fact, he has had only to plough over and to plant anew. Nevertheless, one is reluctantly compelled to admit that the authors of our standard text-books will have to rewrite *ex radice* their chapters on smell, chapters based for the most part on the conclusions of Zwaardemaker in his *Physiologie des Geruchs*, published twenty-six years ago. Twenty-six years make more than half the life-time of experimental psychology, and Henning's criticisms not only are searchingly destructive but also carry full conviction. This conviction is half dismaying and half comforting to anyone who has tried faithfully but unsuccessfully to reproduce the results of Zwaardemaker's compensation and exhaustion experiments or to obtain definite evidence for the Linnaean classification of odors—adopted by Zwaardemaker (be it said) not as final but as one feature of an experimental programme.

The number of Henning's experiments and the expertness of his subjects, in which he has the better of all other experimenters in his field, lend great weight to his positive conclusions. The writer confesses that, when she reviewed early in 1916 (in the *Psychological Bulletin*) the first instalment of his work, she was antagonized by his derisive treatment of earlier experimenters. She also confesses to lacking the wide and exact knowledge of biology and organic chemistry which are necessary for a reliable evaluation of some of Henning's most important findings. But from the experimentalist's point of view, she cannot forbear saying again that one looks almost in vain in his pages for precise details of the procedure employed in particular groups of experiments. One canon of scientific investigation Henning certainly violates to some extent; he seldom makes it possible for convert or critic to reproduce the minutiae of his experimental conditions. To this criticism on his work in classification he has replied by saying (p. 360): "Ich finde, zum Experiment genügt eine Flasche mit Riechstoff, die jeder kennt." With this remark anyone who has worked much with olfactometers must have some sympathy.

Another peculiarity, which seems unfortunate in so polemic a writer as Henning, is that he rarely reduces the introspective data obtained from his subjects to statistical form and does not mention, except to explain away, instances in which their reports conflicted with his conclusions. For the most part, his method of procedure is to state his conclusions dogmatically, but amply to illustrate them from the reports of his observers. He says very truly (p. 360) that the critical introspection of trained psychologists [such as he numbered among his observers] is more valuable than statistics taken on all the students in the University, and that the statistical procedure, about which science in America has so far raved (*immer noch krankt*), has by no means the precision of a qualitative analysis. But the point is not that his experiments were deficient in number or faulty in method—the writer's belief is quite to the contrary—but that he gives us little or no inkling of ever obtaining inconvenient data, and that he thus fails to create an impression of taking a dispassionate attitude toward his own work in comparison with that of others. Nevertheless—whatever omissions of matter or faults of manner Henning's book may show—it not only represents an enormous amount of work both in laboratory and in library, but also represents the application of a keen and original mind to a line of research which has long badly needed and really merited more enthusiastic pursuit.

Even though a large part of Henning's work consists in a critical examination of the 'literature,' it is impossible in the space allotted to summarize his book at once completely and clearly. It seems best, therefore, to confine the remainder of this review to indicating in the briefest possible fashion the character of his subjects, material and apparatus, to stressing two or three important points which he makes in regard to method in smell experiments, and to stating intelligibly those of his conclusions which most strikingly contravert the findings of earlier authorities.

His experiments were made at Frankfort on the Main, where he was *Privatdozent* at the time his book was written. He made more or less extended series of individual experiments on thirteen grown persons and three children. He also made certain group-experiments on forty-six university students. His really most expert subject was his wife, a trained psychologist, who conducted experiments in which he himself had the chance to serve as observer. Of the fourteen chief subjects (including Henning), four were psychologists by profession, six in all were trained psychologists, and ten in all had at least an elementary knowledge of psychology. Of the professional psychologists two—Henning himself and Professor Cornelius—were thoroughly grounded in chemistry, the latter being especially well-acquainted with odorous materials. Of the other subjects, one had considerable knowledge of chemistry, and another was familiar with clinical laboratory-work.

In his chief series of experiments Henning used 415 different scents, selected to represent the whole qualitative range of natural odors and including in about equal numbers chemically pure substances (such as essential oils) and natural scents (such as dried herbs). He also submitted the odors of daily life to systematic examination and even made excursions with his subjects to the Zoölogical Garden and to other places rich in smells in order that no natural odor essentially different from the 415 specimens might escape him. He also made some use of fifty-one odorous trade-articles, such as perfumes, officinal preparations and ink. He kept many of his scents at hand

in five different concentrations. On the average, in his qualitative experiments, about ten smell-exposures were made to a subject at a sitting. For olfactometric purposes he used six different devices, including various forms of Zwaardemaker's olfactometer (which he criticizes severely).

Not the least valuable part of Henning's contribution consists in the following methodological points. First, the quality of a scent cannot be fully appreciated by "monorhinc" smelling, smelling with one nostril only, which is unnatural. From this it follows that mixture of qualities by "dichorhinc" smelling—smelling one with one nostril and another with the other—is unsatisfactory. "Dirhinc" smelling alone gives clear-cut perception. Secondly, reliable judgments with regard to smell-similarities can be obtained only from observers who do not know the nature of the scents with which they are dealing. Henning distinguishes between the true odor (*Gegebenheitsgeruch*), which is obtained by the observer who is smelling with closed eyes and is ignorant of the nature of the scent, and the object-smell (*Gegenstandsgeruch*), which (like color) is projected upon the object from which it is known to come and is apt to be distorted by associative supplementing. Both upon this point and upon that of monorhinc smelling such experience as the present writer possesses is fully in accord with Henning's.

The most revolutionary of Henning's conclusions have to do (1) with the interrelation of smell-qualities, (2) with the phenomena of smell-mixture, (3) with the phenomena of smell-exhaustion, and (4) with the qualities of taste. In the discussion of these conclusions some of his other findings will incidentally appear.

(1) He holds that smells, like colors, constitute a tridimensional manifold, although smell-qualities are related to one another in quite another fashion than are color-qualities. In the first place, the groupings of odors must be represented by a prism rather than by a double pyramid. Of this prism, the triangular faces are equilateral and the rectangular faces are squares. At the angles should stand the most typical smells of his six fundamental classes. At the corners of one triangle should stand respectively the most typical flowery, fruity and putrid smells; at the corners of the other should stand the typical spicy smell on the same edge with the flowery smell on the other triangle, the typical resinous (*harzig*) smell on the same edge with the fruity, and the typical burning (*brenzlich*) smell on the same edge with the putrid. He regards violet as the most typical smell of the flowery class, lemon of the fruity, sulphuretted hydrogen of the putrid, nutmeg of the spicy, frankincense of the resinous, and tar of the burning. Transition-smells lead from every class into every other; the classes which stand diagonally opposite to each other on the square faces of the prism are to be regarded as connected with each other by diagonal lines across these faces. Instances of transition-smells are as follows: (1) between flowery and fruity, geranium and sandalwood; between flowery and putrid, the smell of decaying flowers, and between fruity and putrid, the smell of decaying fruit; between flowery and spicy, thyme and vanilla; between fruity and resinous the various piney odors; between putrid and burning, the ammoniacal animal odors; between flowery and resinous, the smells of the fragrant gums; between fruity and spicy, the mints; between putrid and spicy, garlic; between putrid and resinous, fish-scales; and between burning and all the remaining classes (theoretically at least) the smells obtained by burning scents of these classes. But, in the

second place, odors differ from colors in the fact that likeness between smells does not correspond with an overlapping of the physiological processes concerned. Henning sets his face against specific energies in the realm of smell, against original smells comparable to the *Urfarben* of the color theories. It is only by courtesy that we can say that any natural smell is counterfeited, that the smell of violets, for example, is counterfeited in the perfume industry. The smells at the angles of the prism are indeed related to one another like the colors at the angles of the pyramid, but the smells on any one edge or diagonal are related to one another like the tones in the tonal series. A mixture of two such smells does not result in a simple blend like the orange obtained by mixing red and yellow. In fact, the prism cannot be made to illustrate *both* the transition from one simple smell to another through other simple smells (for example that from lemon to nutmeg through certain minty odors) *and* also the transition from one to the other as produced by mixing the two in varying proportions. For if mixtures are transitional between two smells on the surface of the pyramid, they cannot logically be placed upon a line drawn through its substance. The whole surface of the prism, however, and not merely its edges and diagonals, must be thought of as occupied by simple smells localised according to their two-sided, three-sided or four-sided resemblances. Thus, all simple inorganic scents would stand somewhere on the fruity-putrid, burning-resinous face. The inside of the prism may be vaguely imagined as reserved for unblended mixtures of smells on different faces.

Henning bases his classification primarily on the descriptions given, and the confusions made, by his subjects in extended series of experiments in which they were instructed carefully and without haste to describe the qualities of scents presented. These experiments were supplemented by others in which the observers were given a number of scents and were required to arrange the similar ones in series and to throw out the others. He finds secondary (but probably very real) support in organic chemistry. Assuming that the quality of an odor depends not on the composition but on the pattern of the scent-molecule (which is probably true), he points out a striking sameness of pattern in the benzol rings of the aromatics belonging to any one of his six classes, and also the transitional character of the patterns corresponding to transitional smells. Henning scouts any connection between odor and the periodic system. Odor is as much a constitutive property of the molecule as is fluorescence.

The replacing of the linear or one-dimensional grouping of the Linnaeus-Zwaardemaker classification by a tridimensional grouping appeals strongly to the present writer. An instance of the difficulties which crop up out of the former classification is this: a short-cut apparently exists between the camphor-turpentine and the lemon-rose subgroups (under the "aromatic" group) beside the recognized but longer path through the spices and the mints. Years ago, in personal conversation with the writer, Zwaardemaker noted the resemblance between oil of orange and pure turpentine, and also the difficulty created by the many-phased smell of oil of juniper, which Henning places on the flowery-fruity-resinous-spicy face of his prism.

(2) Henning denies any analogy between the phenomena of color-mixture and those of smell-mixture, which are rather parallel to the phenomena of tonal fusion. When certain smells are mixed, the **result** is indeed comparable to the most perfectly welded chords, which Stumpf admits are simple in direct sensory experience. The best

instances are such natural blends as one encounters in oil of juniper and such stable blends as one finds in the best artificial perfumes. When other odors are mixed, one may have rivalry or the suppression of one smell (or smells) by another. Compensation, the cancellation of one smell by another, is a myth. Henning experimented on forty-six university students with Zwaardemaker's olfactometer and never obtained a single instance. Alleged cases are explicable by fatigue or by exhaustion in the first inhalations of all the free scent-particles in the olfactometer. The phenomenon certainly never occurs in free air. Another possibility, which is best realized in dichorhnic smelling, is the "coincidence-smell," in which the two odors are held apart by a strain of attention (*Aufmerksamkeitsspannung*) and yet have a certain unitary character. Still another possibility, which of course depends on dichorhnic smelling, is the "duality-smell," in which the two components are clearly localized, the one in the right nostril and the other in the left. Blends which are perfect at the first instant of mixture are not necessarily stable. In a little while one may get the coincidence-smell or the duality smell, or one may succeed by shift of attention in making now one and now another smell stand out on a background made up of the rest. This is the phenomenon of the "successive smell." In general, the more similar the smells are, the more perfect their fusion is; within limits their intensity makes little difference.

(3) Henning holds that the phenomena of smell-exhaustion have been exaggerated. He urges with justice that the nervous apparatus of smell should be no more subject to fatigue than is that of the eye or ear. The terminal apparatus of smell may indeed be subject to fatigue, but strong smells cannot be made to disappear merely by exhaustion. Cases of apparent exhaustion are largely explicable by failure of attention to weak and persistent stimuli. Moreover, the effect of fatigue upon the sensory epithelium cannot as yet be distinguished clearly from the toxic effect, local and general, of long continued smelling. Henning describes in detail the toxic effects, marked and lasting for days, produced on one of his subjects by smelling in quick succession 150 different scents, from which substances known to be poisonous had been excluded. The observation was confirmed by experiences with other subjects. The present writer has made similar observations in the case of subjects (particularly herself) who were memorizing long series of smells. But in her opinion, Henning makes too pathological a matter of smell-exhaustion, so-called, and also exaggerates the rôle played by the failure of "sensory attention" in producing insensitiveness to a scent to which one is long exposed. May not smell-exhaustion be comparable with adaptation in the case of other senses? And may not this adaptation be of peripheral origin?

Henning maintains that when sensitiveness to a given smell is dulled by exhaustion, this dullness exists for *that particular odor only*; although, if attention has weakened, it will be poor also for any very similar odor. Aronsohn's method of attempting to arrive at a physiological classification of smells through the effect of exhaustion by one scent upon sensitiveness to another is absolutely valueless. If Aronsohn (says Henning on p. 267) had known the chemical composition of the scents he was using he would never have published his results, for in some instances in which he declared that he could smell one scent but not another, the odorous principle of the two was exactly the same. The differentiation of different parts of the

olfactory membrane to correspond with different smell-qualities is rendered highly improbable by the patchy and asymmetrical distribution of the membrane in the smell-clefts of the two nostrils. Henning points out, it may be said in passing, that the scent-molecules must penetrate into the epithelium and there quickly suffer a chemical decomposition such as to make them odorless, else every smell would persist indefinitely.

(4) No account of Henning's revolutionary findings would be at all complete without at least a brief notice of his taste-tetrahedron. He holds that sweet, salt, sour and bitter are not the only simple tastes, but stand related to one another as do the colors at the angles of the pyramid and the smells at the angles of the prism. Instances of transition-tastes are these: between salt and sour, bicarbonate of soda; between salt and sweet, the alkaline tastes; between salt and bitter, potassium bromide; between sour and sweet, acetate of lead; between sour and bitter, potassium sulphate; and between sweet and bitter, acetone. The phenomena of taste-mixture are closely comparable to those of smell-mixture.

This review does scant justice to the wealth of material in Henning's book, material which must be of great interest alike to the psychologist, the biologist and the chemist. It should give new impetus to experimenters who have put away the scent-bottle and the olfactometer in despair of reproducing or in any way confirming authoritative results which they have not had Henning's (somewhat unhallowed) courage to reject.

Wellesley College

E. A. McC. GAMBLE

The following books have also been received:

- W. BRUHN. *Theosophie und Anthroposophie*. Leipzig and Berlin, B. G. Teubner, 1921. Pp. 108.
- J. COHN. *Führende Denker. Vierte Auflage*. Leipzig and Berlin. B. B. Teubner, 1921. Pp. 117.
- B. ERDMANN. *Grundzüge der Reproduktionspsychologie*. Berlin and Leipzig, W. de Gruyter & Co., 1920. Pp. viii., 186. \$1.80.
- S. FREUD. *Drei Abhandlungen zur Sexualtheorie. Vierte Auflage*. Leipzig and Wien, F. Deuticke, 1920. Pp. vii., 104.
- J. L. DES BANCELS. *Introduction à la psychologie: l'instinct et l'émotion*. Paris, Payot & Cie., 1921. Pp. 286.
- D. I. BUSHNELL, JR. *Native Cemeteries and Forms of Burial East of the Mississippi*. Bureau of American Ethnology, Bulletin 71; Washington, D. C., Government Printing Office, 1920. Pp. 160.
- A. GEMELLI. *Le dottrine moderne della delinquenza*. Milan, Societa Editrice 'Vita e Pensiero,' 1920. Pp. xvi., 212.
- C. READ.—*The Origin of Man and of his Superstitions*. Cambridge, The University Press, 1920. Pp. xii., 350.
- M. HAMBURGER. *Vom Organismus der Sprache und von der Sprache des Dichters*. Leipzig, F. Meiner, 1920. Pp. vii., 189.
- C. PLATT. *The Psychology of Thought and Feeling*. New York, Dodd, Mead & Co., 1921. Pp. x., 290.
- C. BAUDOUIN. *Suggestion and Autosuggestion*. Translated by E. and C. Paul. New York, Dodd Mead & Co., 1921. Pp. 349.
- L. VIVANTI. *Principii di Etica*. Rome, P. Maglione & C. Strini, 1920. Pp. viii., 314.
- A. S. EDWARDS. *The Fundamental Principles of Learning and Study*. Baltimore, Warwick & York, 1920. Pp. 239.